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STUDIES ON VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN SOME QUANTITATIVE CHARACTERS IN BREAD WHEAT (*TRITICUM AESTIVUM* L)

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ABSTRACT

An experiment was conducted on genetic variability, heritability and genetic advance in wheat population, including 48 F_1's + 48 F_2's + 16 parents in RBD during Rabi 2014-15. Analysis of variance for the design of experiments revealed that mean squares due to treatments were highly significant for all the ten characters studied, while mean squares due to replications were non-significant in both F_1 and F_2 generations. The highest estimates of phenotypic and genotypic coefficient of variation (>20%) were recorded for grain yield per plant and biological yield per plant only in the F1 generation. Whereas, in F_2 generation, moderate estimates (10-20%) of PCV and GCV observed in grain yield per plant and biological yield per plant, whereas the number of effective tillers per plant and plant height in both F_1 and F_2 generations exhibited moderate PCV and GCV. High estimates of heritability were observed for plant height followed by 1000 grain weight, days to maturity and grain yield per plant in both F_1 and F_2 generation. Genetic advance in per cent of the men were high for grain yield per plant, biological yield per plant, plant height in both F_1 and F_2, whereas, the number of effective tillers per plant in F_1 only, which in fact demonstrated the presence of additive gene effects indicating the effectiveness of selection for improvement of these traits.

KEYWORDS: Genetic Variability, Heritability Genetic Advance, Quantitative Characters & Bread Wheat

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Original Article

INTRODUCTION

Wheat (*Triticum aestivum* L.; 2n=42) is a self-pollinated crop which belongs to *Poaceae* family and is one of the most leading cereal of the world including India. It is the most important food crop of India and is a main source of protein and energy. In India, wheat is the second most important food crop after rice both in terms of area and production. It is a C_3 plant grown in temperate, irrigated to dry and high-rain-fall areas and in warm, humid to dry, cold environments. The record production in the country during the last few years has enabled India to attain the position of being the second largest producer of the wheat in the world. Hence, in present investigation an attempt was made to assess the variability on grain yield and biological yield contributing traits which indicates genetic variability *i.e.* genotypic coefficient variation (GCA), phenotypic coefficient variation (PCV), environment coefficient variation (ECV), heritability in the broad sense (h^2bs), genetic advance (GA) in per cent of the mean.

METHOD AND MATERIALS

The experimental material consisted of 112 treatments including 48 F_1's + 48 F_2's + 16 parents and was conducted at the Main Experiment Station of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during R*abi*, 2014-15 in Randomized Block Design with three replications in a

single (F_1's), two (parents) and four rows (F_2's) plot & of 3 m length with inter and intra-row spacing of 23 and 10 cm, respectively. On the basis of 15 randomly selected plants, data were recorded on days of 50 per cent flowering, days to maturity, plant height (cm), number of effective tillers per plant, number of spikelets per spike, number of grains per spike, 1000-grain weight (Test weight) (g), biological yield per plant (g), harvest index (%) and grain yield per plant (g). Data recorded at above quantitative traits were subjected to statistical analysis following analysis of variances Sukhatme (1967), heritability in the broad sense (H_{bs}) and genetic advance (GA) (Robinson *et al.*, 1949).

RESULTS AND DISCUSSIONS

Analysis of variance for the design of experiments revealed that mean squares due to treatments were highly significant for all the ten characters studied in Table 1. The existence of genetic variability in the population provides ample opportunities for selection being effective. The pool of genotypes was, therefore, assessed for variability analysis. The existence of wide diversity among the constituent genotypes with regard to characters under study was confirmed through various statistical parameters. The basic material, therefore, offers positive opportunities for the investigation furtherance of the aforesaid objectives.

The estimates of mean, range, variance, heritability (Broad sense) and genetic advance in per cent of mean presented for both F_1 and F_2 generations in Table 2. The grain yield per plant among parents ranged from (5.97 and 6.13g) DBW 17 to (9.78 and 9.56) NW 5054 in both F_1 and F_2 generations, respectively, while among the crosses, ranged from 10.62 (K 8027 X NW 1014) to 16.16 (NW 5054 X K 911) in F_1 and from 5.89 (DBW 17 X K 911) to 10.08 (HPW 355 X NW 1067) in F_2 generation. The highest estimates of phenotypic and genotypic coefficient of variation (>20%) were recorded for grain yield per plant and biological yield per plant only in F_1 generations. The characters which exhibited moderate estimates (10-20%) of the PCV and GCV were grain yield per plant and biological yield per plant and number of spikelets per spike exhibited moderate PCV in F_1 generation only. Whereas, number of effective tillers per plant and plant height in both F_1 and F_2 generations. The rest of the characters showed low estimates (<10%) of PCV and GCV in both F_1 and F_2 generations. These findings were in conformity with finding of Panwar and Singh (2000), Kumar *et al.* (2003), Cheema *et al.* (2006) and Nagireddy and Jyothula (2009). A high estimate of heritability in the broad sense (>75%) was recorded for all the characters except for a number of effective tillers per plant (73.90 and 49.57%) and harvest index (37.12 and 51.33) in both F_1 and F_2 generations. The highest estimates of heritability were observed for plant height (97.70 and 97.55%) followed by 1000 grain weight (96.59 and 96.58%), days to maturity (96.21 and 95.54%) grain yield per plant (93.85 and 80.33%) in both F_1 and F_2 generations. The high estimate of genetic advance in per cent of the mean (>20%) was observed in grain yield per plant (45.99 and 23.93%) followed by biological yield per plant (45.05 and 22.63%), plant height (20.53 and 21.65%) in both F_1 and F_2, whereas, the number of effective tillers per plant (28.22%) inF_1 generation only. A moderate estimate of genetic advance in per cent of the mean (>10% - <20%) was observed for a number of spikelets per spike (19.40 and 11.77%) followed by 1000-grain weight (14.93 and 13.77%) in both F_1 and F_2 generation, while number of grains per spike in F_1 generation only. High heritability coupled with a high estimate of genetic advance in per cent of the men was observed for plant height, and grain yield per plant in both F_1 and F_2 generation, while biological yield per plant in F_1 generation only. High heritability coupled with moderate estimate of genetic advance in per cent of mean was recorded for all the characters except days to 50 per cent flowering, days to maturity, and harvest index in both F_1 and F_2 generation, whereas, number of grains per spike in F_1 generation which exhibited high or low heritability coupled with low genetic advance in per cent of mean, which in fact demonstrated the presence of additive gene effects

indicating effectiveness of selection for improvement of these traits. High heritability coupled with moderate genetic advance was observed for only harvest index. Similar finding were reported by Kisana *et al.* (1982), Abid and Mohammad (1993), Prasad *et al.* (2006), Saxena *et al.* (2007), Yousaf *et al.* (2008), Rahman *et al.* (2008), Nagireddy and Jyothula (2009). High to medium values of heritability estimates were found associated with moderate expected and actual gain in the most traits. These obtained results indicated that, these traits could be used in the early generation, but would be more effective if postponed to late generation (Kaumber and Gammaal, 2012).

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APPENDICES

Table 1: Analysis of Variance for 10 Characters in Wheat (Parents, F_1's and F_2's)

Characters D.F.	Sources of Variation					
	Replications		Treatments		Error	
	2		63		126	
	F_1	F_2	F_1	F_2	F_1	F_2
Days to 50% flowering	1.52	1.91	47.26**	34.48**	1.16	1.11
Days to maturity	0.28	1.96	88.95**	74.75**	1.16	1.14
Plant height (cm)	2.10	0.17	245.41**	249.21**	1.91	2.07
Effective tillers per plant	0.50	0.01	2.23**	0.64**	0.23	0.16
Spikelets per spike	0.26	0.23	10.81**	3.63**	0.44	0.30
Grains per spike	1.39	0.47	58.68**	16.38**	3.68	2.08
1000 seed weight (g)	0.10	0.42	26.13**	21.51**	0.30	0.25
Biological yield per plant (g)	15.78	0.83	145.16**	23.24**	5.97	3.23
Grain yield per plant (g)	0.71	0.62	22.92**	3.61**	0.49	0.27
Harvest index (%)	1.79	0.30	3.70**	4.63**	1.33	1.11

***** Significant at 5% and 1% probability levels, respectively**

Table 2: Estimate of Range, Mean, Coefficient of Variation (PCV and GCV) Heritability and Genetic Advance for 10 Characters in Wheat (F_1 & F_2)

Characters		General Mean ±SE	Range		Coefficient of Variation (%)		Heritability in Broad Sense (%)	Genetic Advance	Genetic Advance in Per Cent of Mean
			Parents	Crosses	Phenotypic	Genotypic			
Days to 50% flowering	F_1	90.14±0.62	75.33-97.67	83.67-95.00	4.51	4.35	92.97	7.79	8.64
	F_2	87.68±0.61	78.67-97.00	83.67-92.67	3.99	3.80	90.93	6.59	7.47
Days to maturity	F_1	122.64±0.62	117.00-135.67	119.00-137.67	4.41	4.32	96.219	6.29	8.73
	F_2	128±0.62	115.67-134.00	116.00-134.67	4.13	4.04	95.54	2.52	9.97
Plant height	F_1	85.28±0.80	68.56-109.85	75.96-114.81	10.20	10.08	97.70	8.83	20.53
	F_2	45.64±0.83	67.13-105.01	68.01-11.72	10.77	10.64	97.55	7.24	21.65
Effective tillers per plant	F_1	4.23±0.28	3.60-5.33	3.73-7.20	18.53	15.93	73.90	0.56	28.22
	F_2	16.38±0.23	3.60-4.87	3.40-5.13	13.44	9.46	49.57	0.34	13.72
Spikelets per spike	F_1	18.58±0.38	14.93-19.53	16.27-22.73	10.62	10.00	88.62	4.21	19.40
	F_2	42.41±0.31	14.47-19.73	13.60-19.73	7.24	6.43	78.88	4.45	11.77
Number of Grains per spike	F_1	47.87±1.10	40.67-50.52	41.83-56.75	9.80	8.94	83.23	22.82	16.81
	F_2	39.14±0.83	38.60-50.83	37.00-50.63	6.17	5.15	69.56	11.96	8.84
1000 seed weight (g)	F_1	39.80±0.31	14.01-45.22	32.97-47.01	7.50	7.37	96.59	0.09	14.93
	F_2	19.81±0.29	33.92-45.18	32.74-45.50	6.92	6.80	96.58	0.12	13.77